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Guided Inquiry Learning Model Using Scientific Argumentation Activities to Improve Concept Understanding on Optical and Light

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Abstract

Problem-solving ability, as one of the most important skills in the 21st century, must be improved to face the various challenges that exist. This is because solving problems requires mastery of the concepts underlying them. One learning model that can improve conceptual understanding is guided inquiry using scientific argumentation activities. This study aims to analyze the effectiveness of the guided inquiry learning model using scientific argumentation activities to improve junior high school students' conceptual understanding. This quasi-experimental study used a non-equivalent control group design. The results of data analysis using the Wilcoxon test showed that there were significant differences in the pretest and posttest of each class before and after treatment. The results of the Mann-Whitney test at the pretest showed that there was no significant difference, while the posttest showed that there were significant differences between the control class and the experimental class. The results of the N-Gain test in the experimental class in the high category indicate that the use of guided inquiry with scientific argumentation activities could increase students' conceptual understanding more than in the control class in the medium category. The result of the effect size test showed that the use of guided inquiry with scientific argumentation activities has a moderate effect on students' understanding of concepts.

Keywords: concept understanding, guided inquiry, argumentation

INTRODUCTION

Understanding the concept is the basis and an important stage in a learning process. Anderson & Krathwohl in Muna (2017) explained that concept understanding is the result of cognitive learning which includes the ability to restate concepts that have been obtained and intellectual abilities (knowladge). With an understanding of the concept students will be able to solve problems properly and correctly and be able to increase student knowledge. Dewi (2020) understanding the concept becomes a very important capital in solving certain problems. This is because solving problems requires mastery of the concepts that underlie these problems. Problem solving ability as one of the important skills in the 21st century must be improved in facing the various challenges that exist. The importance of understanding the concept of science is contrary to the existing conditions. The results of the assessment of studying science at the international level via Program for International Student Assessment (PISA) 2018 Indonesia is ranked 70th out of 78 participating countries (OECD, 2018). In addition, based on the results of the 2019 national exam, the average value of science subjects is only 48.79. The results of the value of science subjects are in the bottom two before mathematics (Kemendikbud, 2019). A preliminary study conducted at SMP Negeri 6 Temanggung showed that students' conceptual understanding of science concepts was still low. The reason for the low understanding of concepts is due to several things, including teacher-centered learning.

Indicators of understanding the concept according to Anderson & Krathwohl consist of: interpreting (interpreting), namely changing information into other forms of information, for example from words to graphics or pictures, or vice versa, from words to numbers. , or vice versa, as well as from word to word, for example summarizing or paraphrasing; provide an example (exemplifying), which is to mention an example of a general concept. This ability requires students to identify the characteristics of the concept to make an example using these characteristics; classifying , namely recognizing and including an object or phenomenon in a certain category; summarizing , namely making a statement or abstract from an article that represents the entire information; draw inference (inferring), namely determining patterns based on examples or facts; comparing, namely finding similarities and differences in an object, idea or situation; and explaining (explaining), namely compiling concepts and using a causal model in a system (Muna, 2017).

At the time of observation, some science materials must be given contextually so that students understand more easily. Optical and light material is one of the materials that has not been given contextually, meaning that students are only given memorized concepts or theories. On the topic of optics and light, many materials are abstract, for example in the formation of refractive mirror images. In addition, some students also find it difficult to calculate the concepts and solve physics problems. Students also have difficulty conveying the material they understand to others. This is because students only understand what is conveyed, cannot understand the concept as a whole. Due to low concept understanding , students cannot express their opinions properly during the learning process. This is also influenced by the learning that is carried out is still teacher-centered. Therefore, learning activities are needed that are able to encourage and develop students' skills in understanding students' science concepts.

One learning model that is able to provide meaning in understanding the concept of science to students is the guided inquiry learning mode. Guided inquiry is a learning model that demands students for more active in activity learning by finding the concept independently and the teacher as a guide (Wisudawati & Sulistyowati, 2014). According to Jufri (2013) the guided inquiry learning model has the following characteristics: students carry out learning that starts from making specific observations that can direct them to make inferences or generalizations; learning activities have the aim of facilitating students in learning or strengthening the concept of an object and finding appropriate generalizations from observations; the teacher controls learning more specifically in the form of phenomena, data, materials, objects, and acts as a leader in the class; each student is directed to try to build meaningful patterns based on his observations independently and his findings with his classmates; the class is coordinated to function as a science laboratory; and the teacher tries to encourage students to practice communicating the results of their observations through presentation activities in front of the class and other students provide feedback.

Research conducted by Ramadhani & Aprilianingsih (2020) states that the use of the guided inquiry learning model is able to improve students' understanding of mathematical concepts. Other studies also mention that the application of the guided inquiry learning model can improve students' conceptual understanding (Hariani, Nuswowati & Winarno, 2020). Based on research conducted by Karsilah, Febriastuti & Siswanto (2017) mentioned that the use of guided inquiry learning model innovation was able to improve the cognitive abilities of junior high school students. Cognitive ability can be included in the indicators of students' understanding of science concepts. According to Stender, Schwichow, Zimmerman, & Härtig (2018) Cognitive skills alone are not enough, students need special scientific reasoning skills to learn the science content of inquiry activities. The use of the guided inquiry learning model is also able to improve students' understanding of mathematical concepts (Ramadhani & Aprilianingsih, 2020).

However, in the guided inquiry learning model, it does not directly facilitate students to practice constructing scientific concepts through scientific argumentation activities. In fact, in the process of learning science, scientific argumentation activities are very important to be trained on students (Marhamah, Nurlaelah & Setiawati, 2017). Argumentation skills have an important role in building an explanation, model, and theory on a concept being studied. Cognitive and affective abilities can be trained through argumentation skills, so that they can help understand scientific concepts (Siswanto, Kaniawati & Suhandi, 2014). Arguments do not only present information but conclusions in solving problems based on theory on a concept, where this refers to understanding the concept (Viyanti, et al., 2016).

Therefore, in this study, scientific argumentation activities will be combined in the science learning process using the guided inquiry learning model. Argumentation is a logical conversation to connect ideas and evidence. Evidence must contain certain objective facts or conditions in order to be accepted as truth. In science learning, argumentation is very important to underlie students in learning to think, act, and communicate like a real scientist (Dwiretno & Setyarsih, 2018). Scientific argumentation in learning activities refers to the Toulmin Argumentation Pattern by Toulmin (2013) consists of claim (claim), evidence (data), justification (warrant), and support (backing). Claim (claims) is a statement submitted at the beginning of the argumentation activity and can be generally accepted as a basis for a thought. Evidence (data) is evidence of a specific nature to support a statement. Justification (warrant) is a supporter between data and claims as beliefs and values that are generally accepted. Support (backing) is additional data, information, and other arguments as further support for the guarantee.

Scientific argumentation skills are very important to be trained on students in science learning. This is done so that students are able to have a clear view, logical reasoning, and rational explanations regarding the material being studied. In addition, argumentation skills are able to equip students in providing explanations related to science phenomena that occur in everyday life based on science concepts (Ginanjar & Utari 2015). Argumentation is able to get special attention in educational research as well as in learning activities (Acar & Patton, 2016). It is hoped that by integrating scientific argumentation activities in the guided inquiry model, students' understanding of science concepts will increase.

Based on this, a research will be conducted to analyze the effectiveness of the guided inquiry learning model using scientific argumentation activities in increasing the understanding of concepts in science learning in junior high school.

METHOD

In this study used quantitative research with a quasi-experimental type. The quasi-experimental design used is the Non-equivalent Control Group Design. This study used two classes consisting of one experimental class and one control class. The experimental class was treated with a guided inquiry using scientific argumentation activities and the control class using a guided inquiry. This study was conducted to analyze the effectiveness of the guided inquiry using scientific argumentation activities in improving the understanding of science concepts for junior high school students on the topic of light and optical instruments.

The population of this research is all students of one of schools in district Temanggung. All eighth grade students consist of eight classes with a total of 253 students. The samples used in this study were students of class VIII from two different classes, namely class VIII G and class VIII H with the number of each class being 32 students, so that a total of 64 students. The selected sample was then divided into two classes, namely class VIII G as the control class and class VIII H as the experimental class.technique sampling used is purposive sampling. This technique is used because of several considerations, namely that the two sample classes taken have the same characteristics, namely teachers who teach the same, background abilities and average student learning outcomes are the same, and students have not taken learning materials with optics and light topics.

The variables of this study consisted of independent variables, control variables, and dependent variables. As the independent variable, the guided inquiry uses scientific argumentation activities in the experimental class and the guided inquiry in the control class. As control variables, namely the topic of optics and light. As the dependent variable in this study, namely the understanding of students' concepts.

The data collection technique used was the pretest and posttest which contained science questions that could measure the conceptual understanding of grade VIII junior high school students on the topic of optics and light. This test is used to obtain information about the conceptual understanding of eighth grade junior high school students about optics and light. The test is in the form of a multiple choice numbering 14 with four answer choices. Before being used as a research instrument, the written test items were tested for validity and reliability.

Validity test is used to indicate the level of validity or authenticity of an instrument. In this study the validity test consisted of content validity and item validity. Content validity relates to the quality of the content of an instrument by testing it on five experts. The results of the expert's assessment were then calculated using the formula in the Aiken V test. The instrument is said to be valid if the value of V is greater than the value of V table in Aiken's V table. Aiken's V test formula (Azwar, 2014) is as follows:

$$V = \frac{\sum s}{[n(c-1)]} \quad (1)$$

Keterangan :
V : v score
s : r – lo
lo : the lowest validity rating score
n : number of appraisers
c : the highest validity rating score

The reliability test is the level of consistency of an instrument which is carried out by testing questions on 32 students. Interpretation criteria value of r can be seen in Table 1.

Table 1. Interpretation of r

Value of r	Criteria
$0,80 \le r < 1,00$	Very strong
$0,60 \le r < 0,80$	Strong
$0,40 \le r < 0,60$	Enough
$0,20 \le r < 0,40$	Low
$0,00 \le r < 0,20$	Very low

The data obtained were then analyzed by calculating the pretest and posttest, calculating the average pretest and posttest, significance test, N-Gain test, and effect size.

The data obtained were analyzed by calculating the results of the pretest and posttest. Pretest and posttest are converted on a scale of 0 to 100. The value conversion formula is as follows:

$$\text{Score} = \frac{\text{Total Score}}{\text{Maximal Score}} \times 100 \qquad (2)$$

The value data that has been obtained is then analyzed for the average pretest and posttest scores between the experimental class and the control class. The average value (Sugiyono, 2017) is calculated using the following formula:

$$\text{Average} = \frac{\text{Total Score of All Students}}{\text{Number of Students}} \qquad (3)$$

Significance test was conducted to determine the relationship between the independent variables and the dependent variable. As a prerequisite for the significance test, the normality test and homogeneity test were carried out.

The Normality Test was carried out to find out whether the data obtained was normally distributed or not. The normality test was carried out using the Kolmogorof-Smirnov test (Sundayana, 2014). Based on the results of the calculation of the normality test, it is known that the data is not normally distributed.

Homogeneity test was carried out to obtain information whether the data is homogeneously distributed or not. The homogeneity test calculation uses the homogeneity of variance with the SPSS version 25 program at a significant level of 5% or 0.05 (Emzir, 2013). Based on the results of the homogeneity test calculations, it is known that the data is not homogeneous.

The Wilcoxon test is a non-parametric test to measure the significance of the difference between two groups of paired data that are ordinal or interval scale but the data is not normally distributed (Sugiyono, 2018). The data is said to be different if the Asymp. Sig. (2-fish) less than 0.05.

The Mann Whitney test is a non-parametric test to measure the significance of the difference between two independent data groups if one or both data groups are not normally distributed (Emzir, 2013). The data is said to be different if the Asymp. Sig. (2-fish) less than 0.05.

The gain normality test (N-Gain) was carried out to determine the magnitude of the change between the results before treatment (pretest) and after treatment (posttest). In carrying out the N-Gain test, calculations can be carried out using the N-Gain formula.The formula for calculating the N-Gain value from Hake in Imamuddin (2020) is as follows:

$$\text{N} - \text{Gain} = \frac{\text{Postest score} - \text{Pretest score}}{\text{Maximal score} - \text{Pretest score}} \qquad (4)$$

In addition, Test *effect size* used to determine the effectiveness of the *guided inquiry learning model* using scientific argumentation activities on students' conceptual understanding. The calculation of the *effect size value* uses the Cohen's d formula from Thalheimer & Cook in Semerci & Batdi (2015) as follows.

$$\text{d} = \frac{\overline{\text{X}}_\text{t} - \overline{\text{X}}_\text{c}}{\text{S}_\text{pooled}}$$

$$\text{S}_\text{pooled} = \sqrt{\frac{(\text{n}_\text{t} - 1){\text{S}_\text{t}}^2 + (\text{n}_\text{c} - 1){\text{S}_\text{c}}^2}{\text{n}_\text{t} + \text{n}_\text{c}}} \qquad (5)$$

Information:

d : *effect size*

$\overline{X}_t$: gain average of experimental class

$\overline{X}_c$: average gain of control class

S_t : standard deviation of the experimental class

S_c : control class standard deviation

n_t : the number of samples of the experimental class

n_s : number of control class samples

RESULT AND DISCUSSION

This study was conducted to analyze the effectiveness of the guided inquiry learning model with scientific argumentation activities in improving the understanding of science concepts for junior high school students of optics and light. The research activity was carried out at SMP Negeri 6 Temanggung for approximately five months starting from December 10, 2020 to May 31, 2021. Data collection and learning activities were carried out online (on the network). by using google meet, google forms, WhatsApp, and virtual simulations such as PhET simulation and physics.

The results of the student's concept understanding test showed that the guided inquiry learning model with scientific argumentation activities was effective in improving students' conceptual understanding. This can be seen from the results of students' understanding of concepts in the experimental class which is higher than the control class. The experimental class used a guided inquiry learning model using scientific argumentation activities, while the control class only used a guided inquiry learning model. The result of pretest and posttest can be seen in Table 2.

Table 2. Results of *Pretest* and *Posttest*

Mark	Experiment Class		Control Class	
	Pretest	*Posttest*	*Pretest*	*Posttest*
Highest	79	100	79	93
Lowest	43	71	43	64
Average	60	87	60	81

The average value of the pretest results of the experimental class and the control class is the same, namely 60. However, the average value of the posttest results is *different in* the experimental class by 87, while in the control class it is only 81. Therefore, from these results, it can be said that the experimental class has greater *posttest results than the control class.*

The Wilcoxon test is a non-parametric test that is used to measure the significance of the difference between the *pretest* and *posttest scores* in the experimental class and the control class. Table 3 shows that there are differences in students' conceptual understanding on the results of the students *' pre -test* and *post -test* both in the experimental class and also in the control class.

Table 3. Wilcoxon Test Results

Class	*Asymp* Value *Sig*. (2- *tailed*)	Information
Experiment	0.000	There is a significant difference
Control	0.000	There is a significant difference

In the control class, *guided inquiry* learning model was used. Wisudawati and Sulistyowati (2014), *guided inquiry* learning model is a learning model that requires students to be active and independent in finding concepts. The results of the students ' understanding of concepts before the treatment and after the treatment showed different results. The understanding of students' initial concepts has increased after the learning activities. This is evidenced by the results of the student's average score on the *pretest* is lower than the average score on the student 's *posttest.* These results are in accordance with research conducted by Hariani, Nuswowati & Winarno (2020) which states that the application of the *guided inquiry learning model* can improve students' conceptual understanding.

Guided Inquiry learning model trains students to solve problems independently by using various sources of information according to the topic of the problem. Abidin (2014) states that the *guided inquiry learning model is* able to increase students' understanding of certain problems, topics, and issues. The stages in inquiry-based learning according to Sani (2014) include the process of proposing problems, seeking information to provide temporary answers or hypotheses, testing hypotheses and analyzing results to make conclusions.

In the experimental class, the *guided inquiry* learning model is integrated with scientific argumentation activities. This learning model is an innovation from the *guided inquiry learning model* combined with scientific argumentation activities. The results of the students ' understanding of concepts before the treatment and after the treatment showed different results. The understanding of students' initial concepts has increased after the learning activities. This is evidenced by the results of the student's average score on the *pretest* is lower than the average score on the student 's *posttest.* Yusiran & Siswanto (2016) stated that the implementation of the scientific method using argumentation *settings* can improve students' cognitive abilities with high improvement criteria.

Guided inquiry learning model using argumentation activities not only trains students to solve problems independently, but also provides complete and broader concept knowledge. Siswanto, Kaniawati & Suhandi (2014) which states that cognitive and affective abilities can be trained through argumentation skills, so that they can help understand scientific concepts. The stages in learning this model are in accordance with the stages of inquiry learning according to Sani (2014). However, in the stage of formulating hypotheses and analyzing experimental results, additional arguments are made. Scientific argumentation activities refer to the *Toulmin Argumentation Pattern* which consists of claims (*Claim*), evidence

(*Data*), justification (*Warrant*), and support (*Backing*) (Moon, Stanford, Cole, & Towns, 2016).

The Mann Whitney test is a non-parametric test that is used to measure the significance of the difference in *pretest scores* between the experimental and control classes, as well as the differences in *posttest scores* between the experimental and control classes. The results of understanding students' initial concepts in both classes are the same, meaning that the initial abilities of the two classes are the same. Then on the results of understanding the final concept the results are different, because of the different treatment in each class. The result of Mann Whitney test can be seen in Table 4.

Table 4. Mann Whitney Test Results

Test	*Asymp* Value *Sig*. (2- *tailed*)	Information
Pretest	0.773	There is no significant difference
Posttest	0.022	There is a significant difference

Guided inquiry learning model although it is able to improve students' conceptual understanding, the results are not greater than the *guided inquiry learning model* using scientific argumentation activities. This is because if only using the *guided inquiry learning model* does not train students to construct concepts. Marhamah, Nurlaelah & Setiawati (2017) mention that the *guided inquiry learning model* does not directly facilitate students to practice constructing concepts through scientific argumentation activities. In fact, in the process of learning science, argumentation activities are very important to be trained. Learning steps in the *guided inquiry learning model* and *guided inquiry* learning model using scientific argumentation activities can be seen in Table 5. and Table 6.

Table 5. Learning Steps in the *Guided Inquiry Learning Model*

Learning Stages	Student Activities	Teacher Activities
Preliminary	Prepare for study and pray	Opening the lesson by saying greetings, praying and doing attendance
	Respond by answering questions from the teacher	Giving apperception
	Respond by answering questions from the teacher	Motivate students by providing pictures and questions
	Listening to the delivery of learning objectives	Delivering the learning objectives to be achieved
Core activities	Respond by asking questions related to the material	Delivering material about the properties of light
	Conducting studies to identify problems given by the teacher by looking for references or applicable theories.	Displays readings of phenomena or problems regarding the properties of light
	Formulate problems and formulate hypotheses	Guiding students to formulate problems, formulate hypotheses and distribute worksheets
	Doing practicum with *guided inquiry model*	Guiding students to do practical activities
	Analyzing data based on *guided inquiry -based worksheets*	Guiding students to do data analysis based on *guided inquiry* -based worksheets
	Draw a conclusion	Guiding students in drawing conclusions.
Closing	Collect worksheets	Delivering conclusions and closing the class with greetings and prayers

Table 6. Learning Steps in the *Guided Inquiry Learning Model* Using Scientific Argumentation Activities

Learning Stages	Student Activities	Teacher Activities
Preliminary	Prepare for study and pray	Opening the lesson by saying greetings, praying and doing attendance
	Respond by answering questions from the teacher	Giving apperception
	Respond by answering questions from the teacher	Motivate students by providing pictures and questions

Learning Stages	Student Activities	Teacher Activities
	Listening to the delivery of learning objectives	Delivering the learning objectives to be achieved
Core activities	Respond by asking questions related to the material	Delivering material about the properties of light
	Conducting studies to identify problems given by the teacher by looking for references or applicable theories.	Displays readings of phenomena or problems regarding the properties of light
	Formulate problems and formulate hypotheses using argumentation activities	Guiding students to formulate problems, formulate hypotheses and distribute worksheets
	Carry out practical activities with *guided inquiry models* integrated with scientific arguments	Guiding students to do practical activities
	Analyzing data based on *guided inquiry -based worksheets with* integrated scientific arguments	Guiding students to do data analysis based on *guided inquiry* -based worksheets integrated scientific argument
	Draw a conclusion	Guiding students in drawing conclusions.
Closing	Collect worksheets	Delivering conclusions and closing the class with greetings and prayers

Guided inquiry learning models using scientific argumentation activities is very helpful in the learning process and students' understanding of concepts. In its application, scientific argumentation activities are able to train more varied indicators of understanding concepts. For example, when students are presented with a problem about "Ponds with clear water will look shallower", then in the *guided inquiry learning model* students only answer "Because of the refraction of light". However, when added with scientific argumentation activities, the answers given by students become more complete. Students will develop hypotheses according to the stages of scientific argumentation, namely: "There is light refraction (claim) that occurs when light undergoes a deflection of the direction of propagation (proof) due to passing through two different mediums (justification). When light from the bottom of the pool towards our eyes will be bent away from the normal line because the refractive index of water is greater than the refractive index of air (data)".

The addition of scientific argumentation activities makes students' ways of answering problems more complete. The existence of scientific argumentation activities trains students to find a complete answer to a problem. Ginanjar & Utari (2015) state that the better students' knowledge and understanding of concepts, the more arguments that arise. In addition, with the addition of scientific argumentation activities, students' understanding of concepts increases. This is in line with the research of Eliana & Atmoko (2020) which states that the use of argumentation learning can improve argumentation skills and understanding of physics concepts.

Guided Inquiry learning models using scientific argumentation activities is very helpful in the learning process and students' understanding of concepts. In its application, scientific argumentation activities are able to train more varied indicators of understanding concepts. The following is an example of the results of the preparation of student arguments in working on worksheets based on scientific argumentation activities, namely: Student 1, "Refraction of light (claim) occurs when light experiences a bend in the direction of propagation (proof) due to passing through two different mediums (justification). When light from the bottom of the pool towards our eyes will be bent away from the normal line because the refractive index of water is greater than the refractive index of air (data)"; Student 2, "The refraction of light (claim) is due to the deflection of the direction of light propagation (proof). Light passes through two different mediums, namely air to water (justification) so that the light will be away from the normal line (data)"; and Student 3, "Refraction of light (claim) due to light from air to water (proof) which are two different mediums (justification) so that the pool looks shallow because the refracted light will move away from the normal line of refractive index (data)".

Student's answer shows that in the preparation of the argument the students have indirectly mastered several indicators of concept understanding. Sugandi (2015) states that the application of Toulmin's argument pattern has a major influence on increasing students' understanding of concepts in physics learning. The learning process that applies arguments both in spoken and written form in a structured manner can help facilitate the process of accepting concepts. Learning materials presented in an argumentative manner with complete arguments are able to provide complete knowledge for students. This is in line with the research conducted by Kaya (2013) which states that the use of argumentation in learning is effective in teaching science concepts.

As for the results of the preparation of student arguments, if analyzed, it can be seen that during the implementation of learning, students formulate hypotheses in general and make claims *as* initial statements that underlie a thought. This stage can train students' ability to draw inferences because in the preparation of initial statements students must find a certain pattern based on facts. The stage of compiling evidence (*data*) is specific in supporting the statement, at this stage students are required to find reference sources and the results of observations that have been carried out to support their statements. In addition to the ability to draw inference to find patterns from facts, it also trains the ability to explain in explaining cause and effect to provide reinforcement for statements. It also trains students' ability to provide examples to support existing statements.

The next stage of justification (*warrants*) is to train students to look for other theories to support the existing data and claims. In this stage, students are able to practice their ability to compare similarities and differences between data and claims that can strengthen statements. At the backing stage, compiling additional data to support further statements, so that the statement can be accepted in its entirety. At this stage, train students in drawing inferences to look for additional evidence based on facts and the ability to explain data based on causal models. It also trains the ability to give examples to provide additional evidence, as well as the ability to classify phenomena based on certain categories as additional evidence to strengthen statements.

Another factor that can explain that scientific argumentation activities are able to improve students' understanding of concepts is student participation during active discussions and in preparing arguments. Students who are active in discussions are able to combine existing ideas and provide broader knowledge, so that the arguments formed are complete. Based on this, students' understanding of concepts will also increase. Ramadhani, Johar & Ansari (2021) mention that student involvement in discussion and argumentation has an impact on student knowledge. The result of average N-Gain test can be seen in Table 7.

Table 7. Average N-Gain Test Results

Class	N-Gain Value	Category
Experiment	0.703	Tall
Control	0.543	Currently

Increasing students' understanding of concepts the experimental class and the control class gave different results. The average value of N-Gain in the experimental class is 0.703, in the high category. However, in the control class the average N-Gain value is only 0.543, which is included in the medium category. Based on these results, it can be seen that the increase in students' conceptual understanding in the experimental class is higher than the control class. The use of *guided inquiry* learning models using scientific argumentation activities can improve students' conceptual understanding better. Karsilah, Febriastuti & Siswanto (2017) stated that the application of the *guided inquiry learning model* which was innovated with argumentation activities was able to improve students' cognitive abilities. Cognitive ability also includes indicators of students' conceptual understanding.

Guided inquiry learning models using argumentation activities have a moderate effect on students' understanding of concepts. This is evidenced by the results of the effect size test, which is 0.528, where this figure is included in the medium category. This proves that guided inquiry learning models using scientific argumentation activities has a moderate effect on students' understanding of concepts. Thus it can be said that the learning model is effective in increasing students' conceptual understanding of optics and light.

CONCLUSION

Based on the results of the research and discussion that have been compiled, it can be concluded that the *guided inquiry* learning model using scientific argumentation activities is effective in increasing the understanding of science concepts for class VIII junior high school students on the topic of optics and light. This is due to the existence of argumentation activities that are able to provide complete knowledge and broader insight to students. Suggestions for future research are the implementation of learning in this study is carried out online (in a network), so that further research can be carried out face-to-face in the classroom.

The use of guided inquiry learning models using scientific argumentation activities in further research can be applied to different materials, measuring the abilities of different students, and at different grade levels. The instruments used in this study have not measured all indicators of concept understanding and the distribution of questions for each indicator has not been evenly distributed. In further research, instruments with indicators of complete concept understanding can be used and the distribution of questions for each indicator is evenly distributed.

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